[0033] FIG. **6** is a block diagram illustrating the construction of a tactile input/output device according to the exemplary embodiment of the present invention. As shown, an input end **30** and an output end **40** of the tactile input/output device have a cross structure. Each input cell **31** of the input end **30** and each output cell **41** of the output end **40** do not overlap with each other and are configured to have a cross structure.

[0034] Each input cell **31** of the input end **30** electrically connects with an input controller **33** through an interface **32** (e.g., a multiplexer). Each output cell **41** of the output end **40** electrically connects with an output controller **43** through an interface **42**. In an alternate embodiment, the input controller **33** and output controller **43** may be integrated as a single controller. If a control signal is sensed in response to an input, the controller drives a predetermined driver (not shown) such as an output vibration generator, etc., controlling an output.

[0035] Although described later, the controller can variously control an output scheme depending on the type of input signal. For example, the controller controls the intensity of a vibration output depending on an intensity of a pressure input, thus being capable of providing different levels of intensities of vibration to a user.

[0036] FIG. **7** is a diagram illustrating the construction of a tactile input device according to another exemplary embodiment of the present invention. As shown, the tactile input device includes a plurality of input ends (Y**1**, Y**2**, Y**3** . . .) arranged in column. Each input end has a plurality of input cells **51** arranged at regular intervals. The input cells **51** can be of piezoelectric material, for example, PieZoelectric Transducer (PZT) using a variation of a voltage difference responsive to a pressure, PolyVinyliDene Fluoride (PVDF), etc. The input cells **51** electrically connect to a variable resistor **52**. The input cell **51** each can be matched to a coordinate value as an X-axis. The voltage difference generated by a pressure applied to the piezoelectric material is relatively less than a voltage difference generated by resistance and thus, this feature is used. A conventional tactile display device senses each signal line of an X-axis and a Y-axis in sequence to generate a coordinate (X, Y). However, according to the present invention, only Y-axis value is sensed to determine a signal variation in a cell. That is, it is determined what number of a signal line is sensed by scanning a Y-axis. Then, an X-axis value and a Z-axis value are obtained using only voltage information obtained from the Y-axis. Here, a tactile display device acts as a switch when pressing a piezoelectric material in signal information of the Y-axis signal line. A voltage difference or a current difference according to a variable resistor is changed and an X-axis corresponding to a resistance value at the time is obtained. Also, a small voltage difference is generated when applying a pressure to the piezoelectric material or a dielectric. The small voltage difference is converted into Z-position and thereby attaining the Z-axis value. In other words, the tactile display device recognizes the Y-axis value according to the presence of Y-axis signal. The X-value is obtained using a relatively large voltage difference or current difference when switched on by the piezoelectric material or the dielectric. The Z-value is obtained using a relatively small voltage difference or phase difference of the voltage. The voltage may be used in an AC, a DC or a combination thereof. For example, if a user applies pressure to a predetermined position on a tactile display device, a Y-axis is determined with only the selected position and, by matching a range of a voltage value extracted from Y-axis, X-axis value and Z-axis value corresponding to a pressure value are obtained, thus making the same sensing possible. That is, depending on a resistance value of the variable resistor variable due to a voltage difference of corresponding piezoelectric material, the controller (i.e., the output controller) can control an output generator such as a vibration generator (not shown) to generate a vibration of an intensity corresponding to a preset resistance value.

[0037] As described above, the teachings of the present invention has an advantage of being capable of increasing a contact sensitivity and making more accurate signal sensing possible by reducing a cell thickness, increasing durability of each cell, and reducing a noise caused by mutual interferences through separation between an input cell of a tactile input end and an output cell of a tactile output end. Also, an exemplary embodiment of the present invention has an advantage of, when an input cell and an output cell are attached to each other, reducing the number of times of a repeated switching operation requiring switching off the output cell so as to switch on the input cell, thereby being capable of increasing a response speed and simplifying a complex control circuit. Further, when an input and output are attached to each other, only a simple input touch can be sensed. However, when the two are separated, various intensities and levels of inputs (i.e., pressure intensities, light intensities, etc.) can be sensed. Moreover, unlike a conventional array sensing all of X and Y-axes and then recognizing a position by a combination thereof, an exemplary embodiment of the present invention has an advantage of, by matching a range of a voltage value of only an X-axis to a coordinate, obtaining an X-axis value corresponding to a center value and a Z-axis value corresponding to a pressure value, thus making the same sensing possible while reducing an amount of operation corresponding to a Y-axis value.

[0038] While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A tactile input/output device comprising:

at least one input end comprising a plurality of input cells arranged at regular intervals;

at least one output end comprising a plurality of output cells arranged at regular intervals; and

a controller for sensing an input signal of the at least one input end and controlling the at least one output end to generate a corresponding output signal,

wherein the at least one input end and the at least one output end are installed to form one array with being separated, and

wherein the input cell and the output cell do not overlap with each other.

2. The device of claim **1**, wherein the input cell and output cell are positioned in alternate sequence.

3. The device of claim **2**, wherein the at least one input end and the at least one output end are arranged to overlap with each other in a column direction.

4. The device of claim **2**, wherein the at least one input end and the at least one output end are arranged to cross at right angles with each other.